International Ergonomics Association (IEA) Triennial Congress 2003, Seoul, South Korea

Presented by Cheryl Bennett

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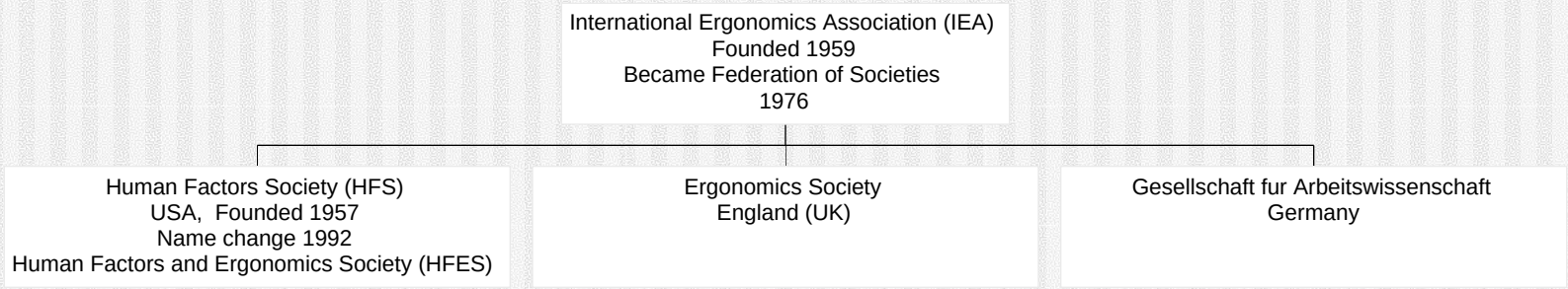
What is the IEA?



In 2003: 41 Member Societies

Attendance at IEA2003: ~ 2500

Number of papers in proceedings: 1274

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Presentation content

Workshop:

- Participatory Ergonomics and Seating Comfort

Papers:

- Seat appearance and sitting comfort
- Use of the computer mouse with the left hand can reduce the postural load on the upper limbs
- Behavioural aspects of developing or sustaining neck and upper limb disorders
- Costs and benefits of design for all
- School ergonomics tour

Workshop: Participatory Ergonomics and Seating Comfort by Peter Vink and Michiel de Looze

- Comfort: no generally accepted model yet
- Subjective phenomenon
  - Determined by various factors; a reaction to environment and product
- How to design a comfortable product is unknown

- Zang et al. (1996):

Discomfort	Comfort
Fatigue	Luxury
Pain	Safe
Posture	Well-being
Stiffness	Relaxation
Heavy legs	

Discomfort/Comfort are thought to be a continuum: maximum possible discomfort to maximum possible comfort

Seat appearance and sitting comfort

[1]Michiel de Looze, [1]Frank Krause, [1]Karen Reijneveld, [2]Pieter Desmet, [1,2]Peter Vink

[1]TNO Work and Employment, The Netherlands, [2]University of Technology, Delft, The Netherlands

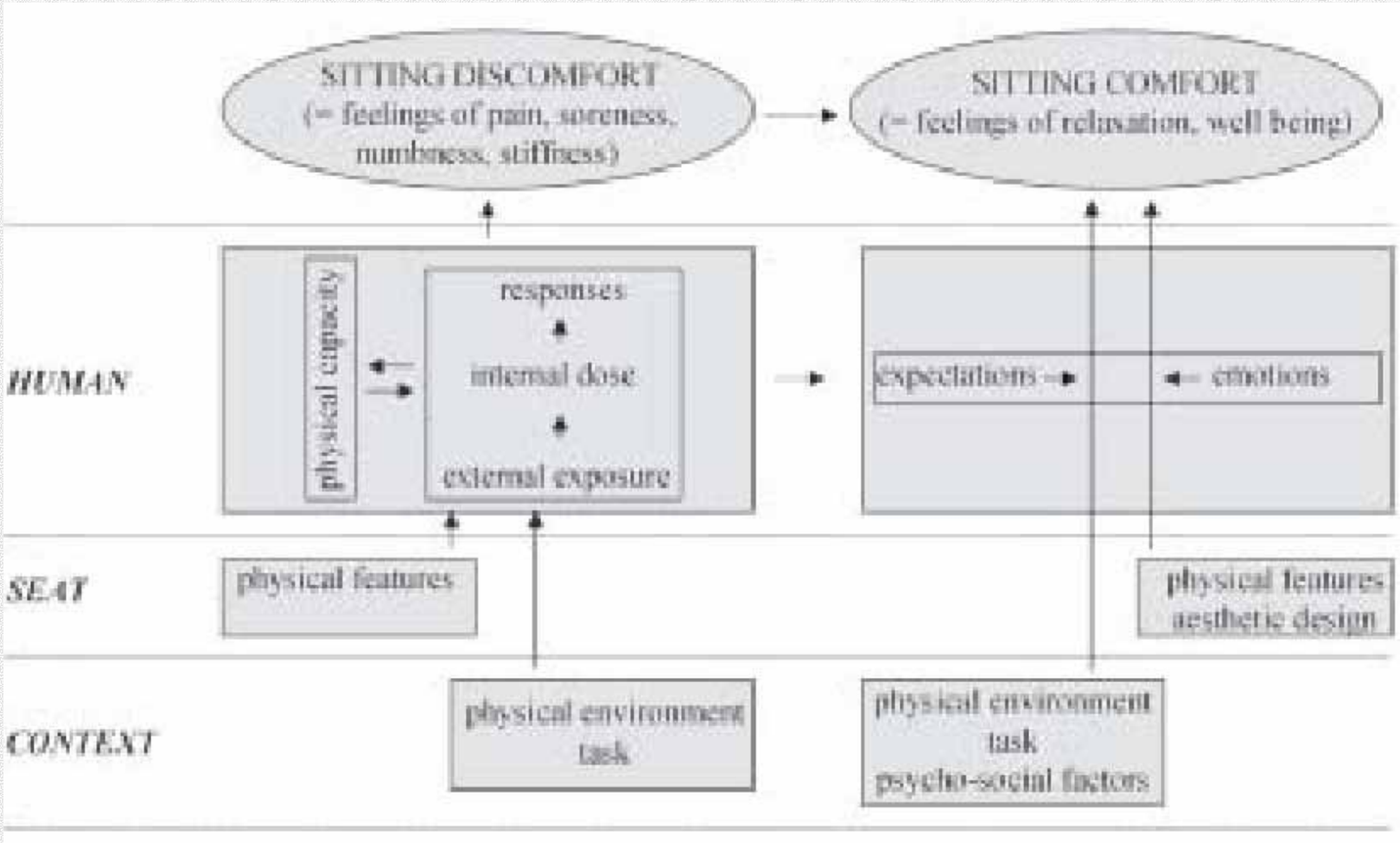
- There is no widespread definition of Comfort

- Feelings of comfort are subjective
  - Associated with general feelings of relaxation and well-being
- Feelings of discomfort
  - Associated with pain, tiredness, soreness and numbness and assumed to be imposed by physical constraints and mediated by physical factors like joint angles, tissue pressure and circulation blockage.

- Objective measures (e.g. pressure distribution measurements, electromyography or posture analysis)are indirect
  - At best, they give an indication of an individuals sitting comfort, but actually, they do measure something else (e.g. pressure distribution, muscle activity or lumbar curvature).

Sitting comfort and discomfort and the relationships with objective measures

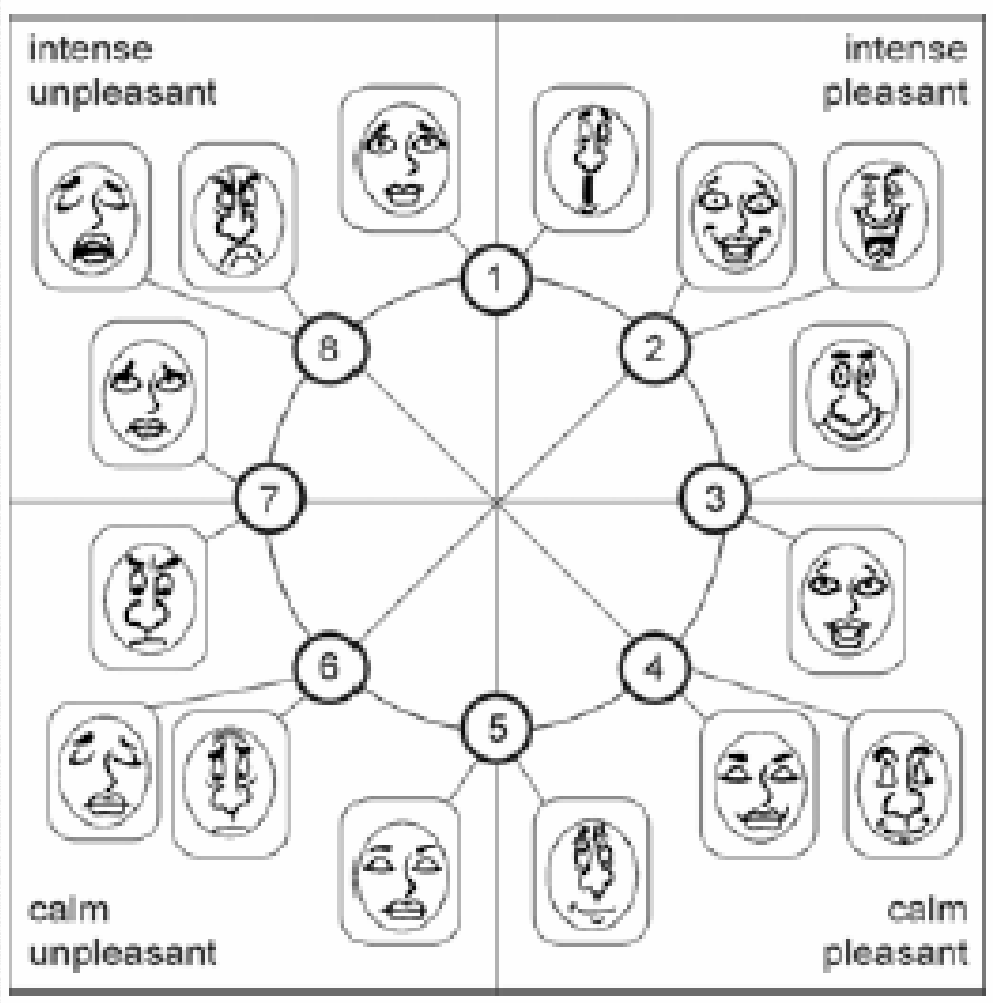
Looze, M.P. de et al. ERGONOMICS, AUGUST, 2003, VOL. 46, NO. 10, 985 – 997



Current study addressing the chair appearance and sitting comfort and discomfort

- Methods to assess emotional response at first sight (Emocards) and the subjective rating on an ugly-to-beautiful scale
  - 15 contemporary office chairs
  - 79 subjects
- How four variables would discriminate among the various chairs
- Additionally, studying the correlations among the various variables

‘Emocards’ 16 different cards: to measure the emotional responses at first sight (i.e. prior to sitting in the chair)



Each octant represented by a male and female face

Methodology

- Subjects first briefly looked at seven chairs
  - subjects were not allowed to touch the chairs.
- Subjects then selected the Emocard best representing their emotional response to a selected chair
  - This was repeated for each chair
- Subjects also selected the Emocard representing the response they would want to experience
- For each chair, the deviation of the actual emotional response from the preferred response was computed

Methodology

- The impact of the chair's appearance was evaluated by a verbal response on a 6- point scale for ugliness vs. beauty
  - very beautiful
  - beautiful
  - a bit beautiful
  - a bit ugly
  - ugly
  - very ugly

- Next, the feelings of comfort and discomfort were measured by using the chair evaluation checklist of Helander and Zhang (1997)

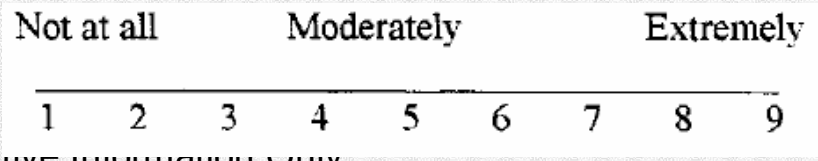
Chair Evaluation Checklist

Helander, M.G. and Zhang, L. 1997. Field studies of comfort and discomfort in sitting, Ergonomics, 40, 895-915.

Descriptor
I feel restful
I feel refreshed
Chair looks nice
I like the chair
I feel relaxed
Chair feels soft
I feel pain
I have sore muscles
I feel restless
I feel stiff
I feel tired
I feel numb
I have heavy legs
I feel uneven pressure
I feel cramped
Chair is spacious

Instructions to subjects:

- Below is a list of statements for evaluating this chair. There are several scales for you to rate. Mark an 'X' on each line at the point that best describes your feelings or your impressions Note:
  - 1= Not at all
  - 9= Extremely

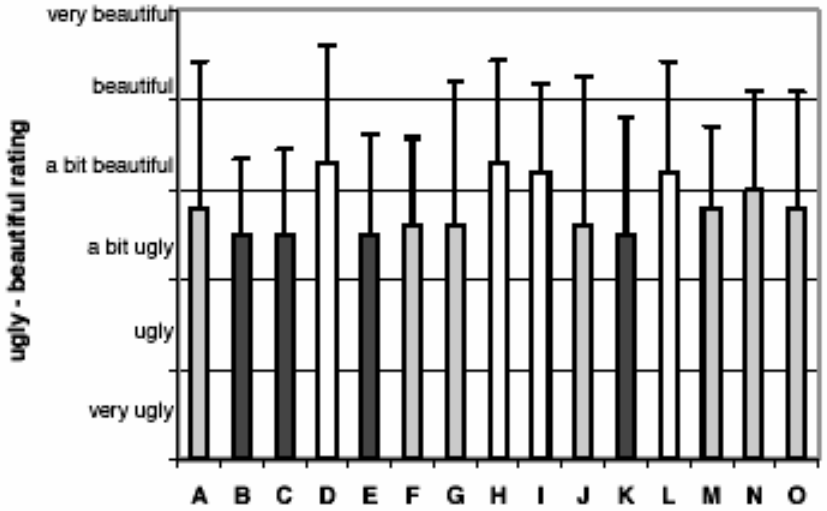


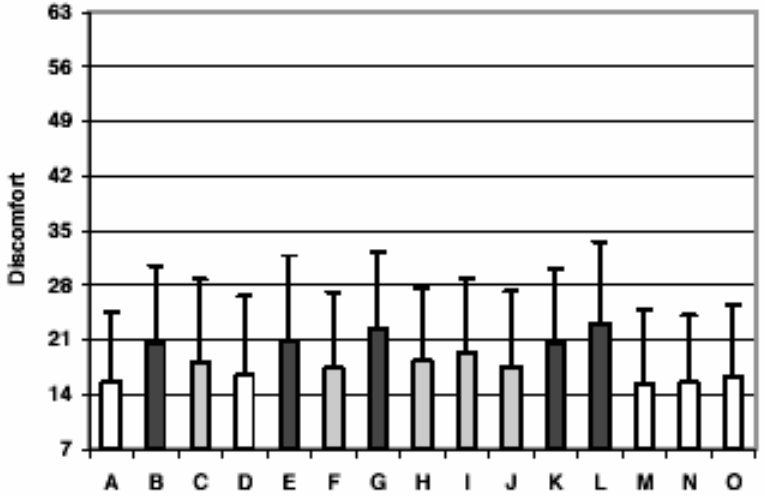
Last steps

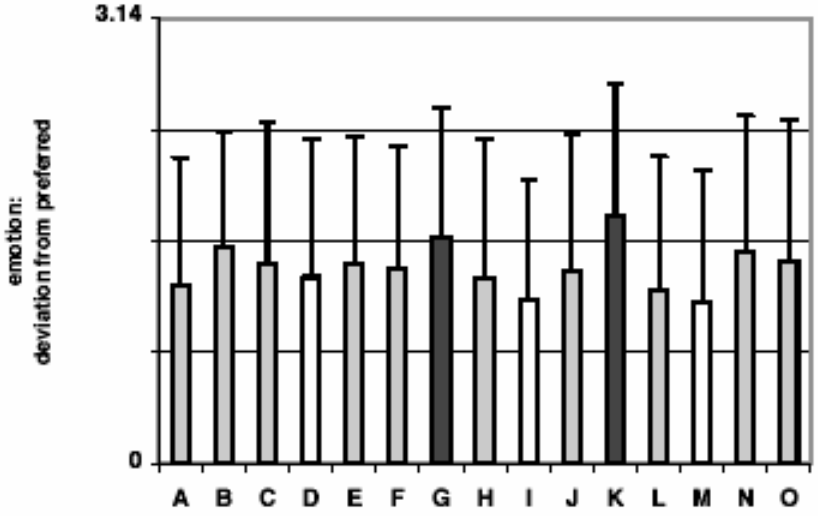
- At this point chairs and table in front of the subject optimally adjusted to subject's anthropometry
- The subjects were allowed to sit for several minutes in the chair.
- General ratings of comfort and discomfort obtained by summing the ratings that subjects gave related to the underlying descriptors of comfort and discomfort.
- The results for each chair were statistically compared (paired t-test, $p = 0.05$) with the average results across chairs.
- Pearson's correlation coefficient was used to measure any association across the various variables.

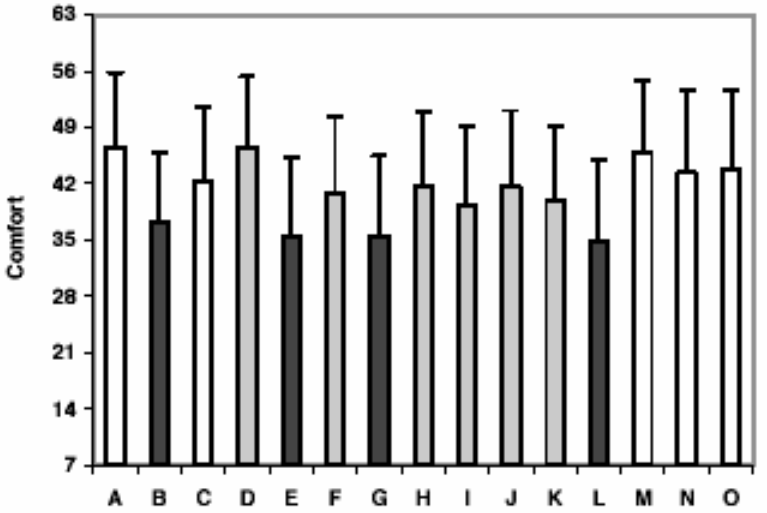
Results for chairs A to O - four variables.

Black bars indicate the chairs that are rated significantly 'worse' than average
White indicate the significantly 'better' than average
All vertical axis run from the minimal to the maximal values.









Major findings from study

- All methods applied lead to significant results among chairs.
- The non-verbal method to measure emotional responses (Emocards) seems to be of additional value to verbal ugly-beatiful rating
- Comfort and discomfort ratings are well in line:
  - the chairs showing significant results for comfort and for discomfort are nearly exactly the same.
- One small but significant correlation across the ratings at sight (prior to sitting) and while sitting
  - correlation of 0.34 between the ugly-beautiful rating and the feeling of comfort
  - This was not found for discomfort.

USE OF THE COMPUTER MOUSE WITH THE LEFT HAND CAN REDUCE THE POSTURAL LOAD ON THE UPPER LIMBS

- Alain Delisle a, Daniel Imbeau b, Brenda Santos b, André Plamondon a, Yves Montpetit c
  - a Occupational Health and Safety Research Institute Robert-Sauvé (IRSST) Canada
  - b École Polytechnique de Montréal, Canada
  - c ErgoExcel Inc., Canada

- Mouse use reported to be associated with
  - Shoulder flexion, abduction and external rotation (Karlqvist et al., 1994)
- Keyboard with numeric keypad
  - Increases distance of the mouse requiring larger shoulder abduction (Cook & Kothiyal, 1998)
- Shoulder flexion and abduction have been identified as risk factors for neck and shoulder musculoskeletal disorders.

Testing impact of using the mouse on the left side of a standard keyboard (with a right numeric keypad) on upper-extremity posture

- Purpose
  - Evaluate the advantages and disadvantages related to different mouse-use strategies on postural constraints and performance, before and after office ergonomics awareness training

- Large company in Canada
- 27 subjects tested baseline and one month after training
  - 24 women (age: 33-51 yrs)
  - 3 men (age: 31-41 yrs)
  - All subjects were right-hand dominant, except one man who was left-hand dominant and another who claimed he was ambidextrous.
  - All subjects were right-handed mouse users, including the left-hand dominant subject and they were all experienced computer users.

Methodology

- Optoelectronic system used to determine the posture of the mouse-operating upper-extremity.
- Experimenter set up computer station configuration at baseline; subject adjusted computer station (chair, monitor height, etc.) at beginning of second session
- Each subject performed the (mouse-intensive) computer task according to three, randomly presented, conditions; use of the mouse with the:
  - 1. right hand, left mouse-button (RL);
  - 2. right hand, right mouse-button (RR),
  - 3. left hand, left mouse-button (LL)

Results

Table 1. Average angles in degrees (standard deviation) for the Session and Condition (RL vs. LL) effects

	Session 1	Sesion 2	RL	LL
Wrist extension	31 (7)	34* (8)	35 (8)	29* (7)
Wrist ulnar deviation	14 (7)	10* (7)	11 (8)	13 (7)
Elbow flexion	62 (12)	57* (12)	56 (11)	67* (12)
Elbow pronation [1]	24 (12)	26 (11)	23 (11)	27 (10)
Shoulder flexion	23 (9)	30* (13)	29 (10)	22* (14)
Shoulder abduction	35 (8)	43* (8)	42 (8)	34* (9)
Shoulder rotation [2]	5 (13)	-5* (15)	1 (14)	-4 (16)

* Significant difference, p≤0,05.

[1] Full pronation corresponds to a zero degree angle;

[2] A zero degree angle corresponds to neutral posture, external rotation is positive.

The use of the mouse with the right hand and right mouse button (RR condition) did not result in any significant changes of posture as compared to the left button use (RL condition). Moreover, there were no significant differences on any of the angles between the trials.

nly

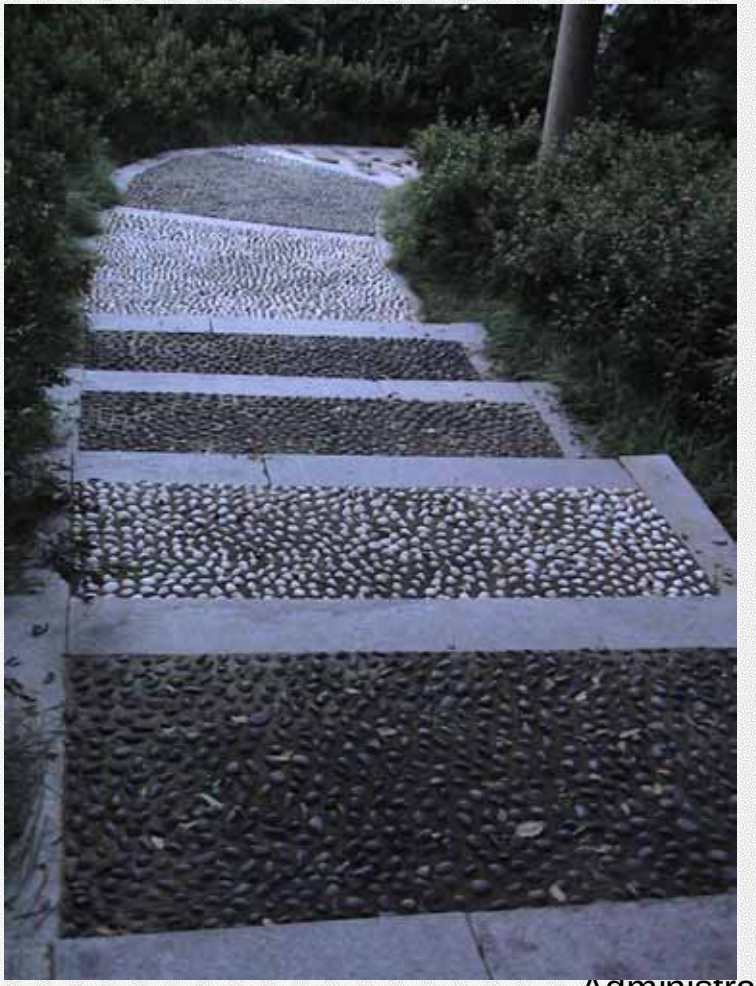
Results: Analyzed separately for those who truly switched to left mouse use and those who did not

- Shoulder abduction
  - -16% left hand mouse use,
  - -9% for those who did not.
- Shoulder flexion
  - -29% left hand mouse use,
  - -9% for those who did not.
- Wrist extension
  - -21% left hand mouse use,
  - -10% for those who did not.
- Time required to perform task
  - +8% for converted left hand users compared to their right hand use time (reduced to 1.6% difference at end of second session)

- Conclusion:
  - Use of the mouse on the left side contributed to reduce the postural constraints of the whole upper-extremity, even without extensive practice

Local highlight:
Private boys school grounds

Reflexology footpath?

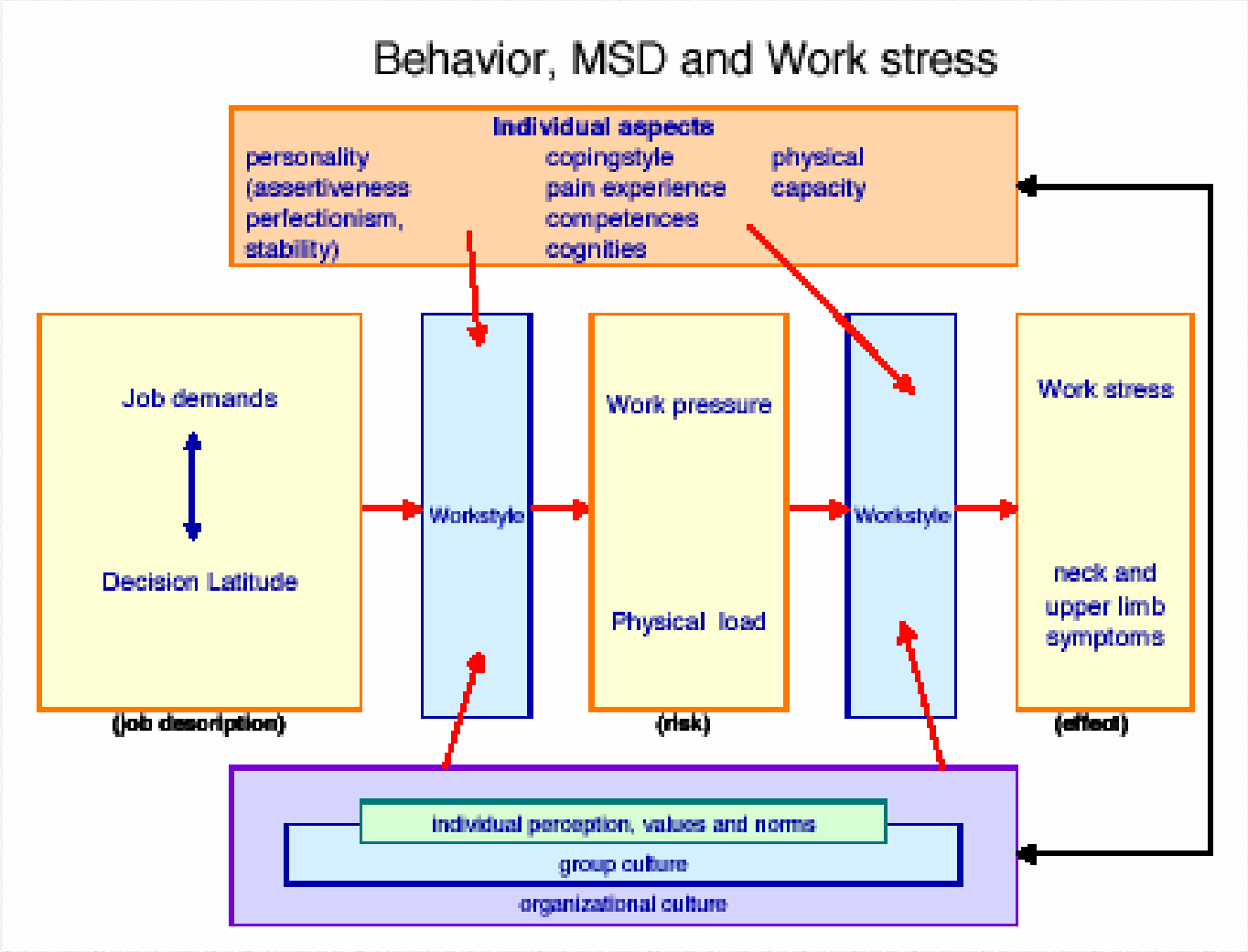


BEHAVIOURAL ASPECTS OF DEVELOPING OR SUSTAINING NECK AND UPPER LIMB DISORDERS

K.H. Thé, S.G. van den Heuvel, N.M. Wiezer, P.M. Bongers
TNO Work and Employment, The Netherlands

- Prevention is key in implementing ergonomics programs and both the employer and employee have responsibilities
  - What role does the individual employee play?
  - What is the affect of the work organization or company culture?
- In this study the role of employee behavior, specifically an adverse work style, is linked to the development or perseverance of neck and upper limb symptoms.

Development of work-related neck and upper limb symptoms and stress



Methodology

- 144 employees were questioned
  - on symptoms,
  - behavior
  - workplace ergonomics
  - work organization.
- 10 employees interviewed based on results of questionnaire
  - Neck an upper limb disorders
  - Several different causes mentioned
- Results of questionnaires and interviews presented to a RSI prevention task group within organization

Prevalence of work related risk factors

Table 1 Work related risk factors for neck and upper limb symptoms

Risk factor		Percentage
Ergonomic risk factor	*Duration*	
Computer usage at work	≥4 hours a day	88
Laptop usage	≥2 hours a day	9
Mouse usage	≥4 hours a day	52
Keyboard usage	≥4 hours a day	50
Workplace adjusted to body size		50
Satisfied with workstation		71
Organizational risk factor		
Impossible to alternate computer tasks with non-computer tasks		33
High job demands		59
Low decision latitude		33

Work style risk factors

Table 2 Risk factors for neck and upper limb symptoms related to the work style

Risk factors	Percentage
Hardly ever takes time for a lunch break	34
Continues working with complaints	33
Do not take extra breaks when they have complaints	38
Hardly ever takes break to stretch	31
Does not pay attention to proper working posture	38
Mentions it is impossible to stop because the work needs to be finished	30
Rather works overtime than delay a deadline	30
Is available for work in spare time	47
Think they owe it to themselves to always try to do their best	82

Findings

- Employees with symptoms:
  - spend more time working with a mouse;
  - do not take enough breaks;
  - experience more work pressure;
  - encounter less workplace support;
  - tend to accept a lot of work.
- Aspects associated with adverse work style:
  - Disagree with: “My manager is interested in my welfare”
  - Agree with: “It would not be possible to get another job within the company if my job caused my symptoms”
  - Agree with: “Can discuss health problems with manager but it wouldn’t make a difference
  - Disagree with: “Discussing health problems with my manager usually leads to a practical solution”
  - Agree with: “In this company the well-being/health of an employee are purely seen as his or her own responsibility

Conclusion

- Employees with neck and upper limb symptoms experience higher work pressure and limited workplace support compared to colleagues

- Company culture was identified as an important factor in the creation or maintenance of unhealthy behavior

COMPUTER WORK RELATED SHOULDER PAIN: AN INTERVENTION MODEL

- Kadefors, R.1,2, Sandsjö, L. 1,2 , Hermens, H. 3, Hutten, M. 3, Byström, P. 1,4, Merletti, R. 5
  - 1 National Institute for Working Life West, Göteborg, Sweden;
  - 2 Department of Human Factors Engineering, Chalmers University of Technology, Göteborg, Sweden;
  - 3 Roessingh Research and Development, Enschede, The Netherlands;
  - 4 Department of Psychology, Göteborg University, Göteborg, Sweden;
  - 5 Politecnico di Torino, Torino, Italy

- Chronic shoulder pain a common ailment in computer users
  - higher prevalence in women
- Pains are often localized to the descending portion of the trapezius muscle

Theory and hypothesis

- Hägg (1991Cinderella theory
  - hypothesizes low-threshold motor units, which are always recruited as soon as the muscle is activated, and stay active until total muscular relaxation.
- In the long run and due to lack of recovery, metabolic overload at the cell membrane level may occur, resulting in degenerative processes leading to cell damage, necrosis and pain.
- The aim of the study is to investigate if myofeedback may be able to reduce sustained muscular tension in the upper trapezius muscle.
- It is hypothesized that introduction of longer or more frequent periods of rest in the muscular activation patterns will be instrumental in reducing muscular pain.

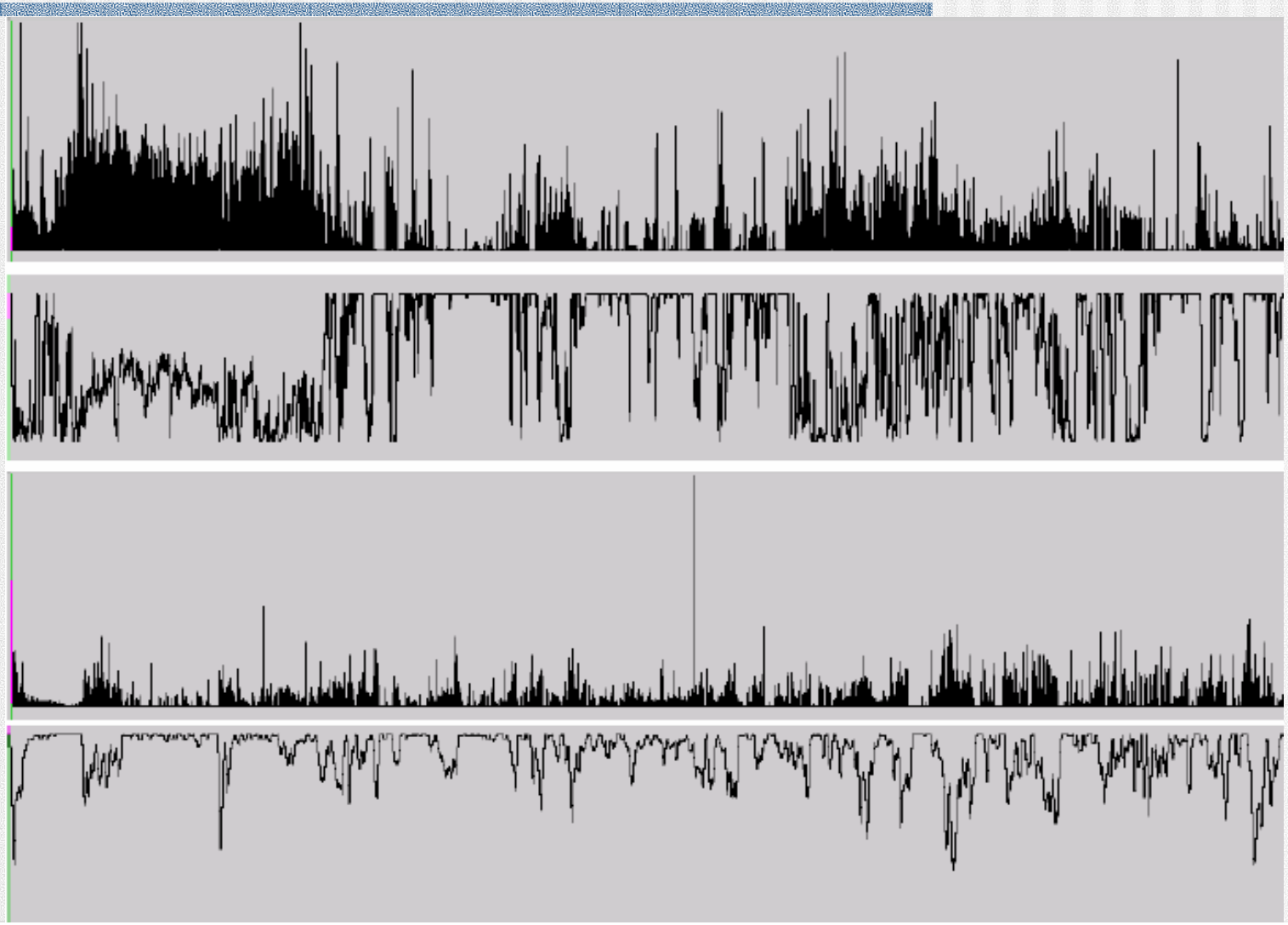
Methodology

- Subjects:
  - Women over 45 years
  - Shoulder pain more than 30 days
  - Work with computers
  - Different companies
- Randomized controlled trial
  - Intervention group: Myofeedback and ergonomic advise at work for 4 weeks
  - Control group: ergonomic advise only
- Baseline measurements; post intervention, 3 month and 6 month follow-up planned\
- Subjects keep diary of work exposure

Notes

- Part of European Union Project
  - Neuromuscular Assessment in the Elderly Worker
- Apparatus designed to be used during normal working conditions
- Software package integrated

Example of 220 minutes (8:00-11:40) of activity and rest time in the left trapezius muscle
(a) during work without myofeedback;
(b) third of myofeedback.
Top: EMG activity (ARV);
Bottom: relative rest time (per cent



COSTS AND BENEFITS OF DESIGN FOR ALL

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1 TNO Work and Employment, PO Box 718, 2130 AS Hoofddorp, the Netherlands,
2 Ministry of Social Affairs, Den Haag, The Netherlands

- D4A
  - Design for All

Hidden costs

- The wages for that day of the absent worker
- The lost production
- The costs of a temporary worker with or without the lower performance
- The costs of a lost client as result of the mistakes made that day.

Aspects to consider are:

- Investments:
  - consultancy, selection of solutions, purchase, installation, training, grants.
- Operation costs:
  - maintenance, space, energy, interest, and personnel costs.
- Health:
  - health complaints, lost working days, disability, insurances, occupational rehabilitation.
- Safety:
  - safety behavior, (near) accidents
- Performance:
  - productivity, time to market, lead time, service level, quality, flexibility, personnel turnover, recruitment power.
- Liability:
  - costs of processes, lawyers, penalties,and claims.
- Values, standards:
  - image: “we pay serious attention to health and safety!”

Calculation

Calculation

Investment	
- the SPH-system costs (installation included)	€ 8.000
- not necessary: wooden floor	- € 1.500
Total investment	***€ 6.500***
Exploitation costs (per year)	
- more fuel (120 kg extra weight)	€ 500
- less wear and tear by better weight distribution	- € 400
Performance	
- quicker work	- € 6.000/year
Health	
- reduction of lost working days	- € 256/year
Total investment	**€ 6.500**
Total annual benefits – costs	**- € 6.156**
Return on investment:	**± 1 year**

Analysis

	method applic-able?	data avail-able?	quantitative data		non financial data	Over all costs - benefits
			number	fin. ratio	number	ratio
Lightweight scaffold platform	yes	+	+	+	++	++
Glass mounting (window panes)	yes	+	+	++	++	++
Full accessibility (buildings)	no	--	--	n.d.	+	++
Loading airplanes	yes	+	++	+/-	+	+
Inflatable mattress	yes	+/-	+	+	++	++
New cleaning tools (home care)	yes	+	++	+/-	++	+
Improved parcels delivery	yes	+	++	++	++	++
Microscope workplace	yes	+/-	++	++	+	++
Mechanical transport in paving	yes	++	++	++	++	++
Mechanical paving	yes	++	++	++	++	++

* n.d. = no data available

Table 1. Summary of the evaluation of ten costs benefits cases in the field of D4A.

School Ergonomics in Korea

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Seoul National University Elementary School Tour

IEA 2006 Maastricht, The Netherlands

Meeting diversity in ergonomics

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